Scientific scope FACCE ERA-Net Plus Call

Scientific scope of the call

The call addresses adaptation of European agriculture to climate change in its broad sense. Four areas are highlighted as key to advancing research in this area:

1. genetics and breeding of animals and plants to increase resilience to climate change;
2. pests and diseases linked to climate and posing significant risks;
3. adaptive management of water and soil resources;
4. options for adapting agricultural systems.

Projects could address these areas individually or in combination.

Genetics and Breeding of animals and plants to increase resilience to climate change:

Preserving genetic resources, defining new breeding targets in response to elevated CO2, to changing climates and abiotic stresses and developing advanced phenotyping for plant and animal breeding. Adapting seeds and breeds through conventional breeding and biotechnologies to new combinations of environment and management, while preserving or improving their productivity potential and their quality. Integrating the rise in atmospheric CO2 (and the potential damages by tropospheric ozone) in crop and pasture species breeding strategies, breeding for heat tolerance (also taking into account phenology), for drought, salinity and flooding tolerance. Breeding for the productivity and higher thermal tolerance of monogastrics and of ruminant livestock species in conjunction with new management systems and variation in feed and feed supply (see below). Exploring the use of genetic resources, e.g. of populations adapted to warmer conditions.

Pests and diseases of animals and plants linked to climate and posing significant risks:

Improved diagnostics, monitoring and epidemiological surveillance for emerging and re-emerging pests and diseases, to enhance climate-informed crop and animal protection strategies. Impact of climate change on the transmission and geographic distribution of pests and diseases, including zoonoses. Epidemiological modeling taking into account changes in the vectors and reservoir species for animal diseases. Climate envelope modeling of weeds, of crop pests and diseases, including interactions with wild hosts, with auxiliaries and with parasites. Novel vaccination strategies for animals and deployment of resistance genes and elicitors for plants. Breeding for increased resistance or tolerance to plant and animal diseases and novel strategies to deploy resistance genes and increasing their longevity. Quantification of the impacts of plant and animal health adaptation on agricultural GHG emissions. Disease risk management procedures.

Adaptive management of water and soil resource:

Adaptation of water and soil management to climate change and climatic variability need to be developed at a range of interconnected scales, e.g. from the field to the watershed, taking into account the diversity of regional contexts in Europe.

Developing and strengthening the strategies to harmonise competing goals such as biodiversity, fertility, land use and productivity for sustainable water and soil management in agriculture, taking into account differences across regions and across agricultural systems. Water capture, storage, advanced irrigation and drainage methods, flood management based e.g. on crop and soil water status monitoring, to sustain production while mitigating GHG emissions. Improved resource-efficient management of nutrients and fertilizers. Increased efficiency in crop water use and in drought and flood tolerance. Improved allocation of irrigation water between users within the agriculture sector and across sectors, including streams, wetlands and other freshwater systems; economic instruments for improving the cost effectiveness of water use, while reducing energy use and greenhouse gas emissions.

Develop options for soil management and tillage. Increasing the duration of soil cover and soil organic matter (as a protection against erosion, drought and to minimise nitrate leaching), while limiting water losses is of particular importance for the adaptation to climate change. Trade-offs and synergies between adaptation and mitigation need to be studied, as for instance, no-till affects both soil water availability, soil carbon and N2O emissions. The indirect consequences of water and land use in Europe for the rest of the world through trade need to be considered in this context as well, including their adaptation and mitigation related effects. Interactions between soil quality and adaptation.

Options for adapting agricultural systems:

Agricultural systems include herbaceous and woody species, annual and perennial crops, livestock and mixed systems and related ecosystems services. Analysis and validation of indicators of sustainability and efficient use of resources and the characterisation of production systems are required. In this area are included: Development and analysis of innovative agricultural and farming systems for 2050 to ensure and sustainably increase biomass production under climate change.

Challenges in global food security under changing climate conditions will be assessed as well as measures to secure biomass production as a base for a sustainable bio-economy.

Adapting livestock systems, both in confined and pasture systems includes effective responses to heat threats, e.g. through changes in the feed supply chain, animal nutrition, in housing conditions (e.g. stables) and in grazing conditions (e.g. shade trees). Responses can be addressed at the feed supply chain, including grazing systems, forage crops and forage conservation, use of crop residues and by-products. Developing animal feeding systems that do not compete with food production (forage based systems). The social, economic and animal health and welfare consequences of the solutions proposed must always be considered.

Adapting cropping systems (annual and perennial crops) and mixed systems, e.g. crop-livestock, agroforestry, food and non-food use, preserving their productivity and their quality and increasing their resilience to climatic variability, also taking into account systemic implications of technical and institutional innovations. Changes at the level of cropping and farming systems, and implications for agricultural landscapes. Address the implications for crop diversification, and technological adjustments in practices and techniques to altered environmental conditions in a near future perspective.

The associated costs and benefits of these approaches need to be assessed for Europe and at regional systems' levels, taking into account climate and market risks and other components of global change, e.g. scarcities in fossil energy and in natural resources. Interactions with farmers and extension services will be required for the design of regional adaptation strategies. Institutional governance options responding to climatic threats such as severe droughts should also be addressed considering the specific implications for strategic agricultural areas or production systems, including those linked to the food industries.